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Kaldis, Fokion ; Karakashev, Dimitar; Angelidaki, Irini

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The biodegradabily of a feedstock is determining the optimal C/N ratios in anaerobic digestion.

Fokion Kaldis [1,2], Dimitar Karakashev [2], Irini Angelidaki [2*] (1) Biological Applications and Technologies, University of Ioannina, Ioannina, Greece, (2) Department of Environmental Engineering , Technical University of Denmark

*Email: iria@env.dtu.dk

Anaerobic digestion is a collection of processes by which different types of microorganisms break down biodegrade material in the absence of oxygen. Microorganisms need nitrogen for building up their cell mass. Approx. 15% of the cell mass is nitrogen. Therefore nitrogen is a necessary nutrient for growth of microorganisms. On the other hand excessive amounts of nitrogen in the form of ammonia are toxic for the microbial growth (Xiaojiao et al 2012 and Kayhanian, 1999). In the past main focus has been paid on the carbon to nitrogen (C/N) ratio as an important parameter for design and operation of AD process. However, this conception is a simplification of the reality and is not connected with any mechanistic explanation. Biomass is degraded to build new cells, with a cell to substrate yield depending on the microorganism and the energy content of the feedstock biomass used as substrate. For a successful balanced process in respect to C/N ratio, we would need exact balance of nitrogen to adequately cover the nutritional needs of the microorganisms, but not excessive to create inhibition problems. Therefore, we hypothesise that the biodegradability of the feedstock is a very important factor which has been ignored so far, in the optimisation of the C/N ratio of the feedstocks.

In order to test our hypothesis we have investigated feedsocks with different biodegradability in order to determine the effect of biodegradability on the C/N ratio, and to establish the connection of the C/N ratio with the cell biomass composition. As model-substrates (feedstock biomasses) with different biodegradability we tested: glucose (easy degradable) and grass (rich in lignocelulose and difficult to biodegrade). Based on literature data for optimal, sub-optimal and super-optimal ranges for C/N ratio following ratio were chosen: 5, 20, and 35 and 50. All experiments took place under thermophilic (55°C) conditions due to its superiority when compared to the mesophilic conditions for the bio-conversion of the substrates into bio-methane. Results obtained can be utilized for development of innovative co-digestion process configuration with substrates with different biodegradabilities

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